

REMARKS

Claims 1, 2, 4-8 and 10-14 are pending in this application. By this Amendment, claims 1 and 6 are amended. Support for the amendments to the claims may be found, for example, in the specification at page 8, line 26 to page 9, line 9, page 14, lines 5-7, and page 17, lines 15-21. No new matter is added.

In view of the following remarks, reconsideration and allowance are respectfully requested.

I. Interview

The courtesies extended to Applicant's representative by Examiner Wartalowicz at the personal interview held September 11, 2009 and the telephone conference held September 15, 2009, are appreciated. The reasons presented at the interviews as warranting favorable action are incorporated into the remarks below and constitute Applicant's record of the interviews.

During the September 15 telephone conference Examiner Wartalowicz suggested that there may be a problem under 35 U.S.C. §112 with claim 1 (and also claim 6). Specifically, the Examiner noted that the recitations "the product" in claim 1 and "the resulting product" in claims 1 and 6 lack antecedent basis. By this Amendment, claims 1 and 6 are amended in light of the Examiner's comments. Accordingly, claim 1 and 6 and their dependent claims satisfy the requirements of 35 U.S.C. §112.

II. Rejections Under 35 U.S.C. §103

The Office Action rejects claims 1, 2, 4-6, 13 and 14 under 35 U.S.C. §103(a) over U.S. Patent No. 5,023,071 to Sherif (hereinafter "Sherif") in view of U.S. Patent No. 5,863,850 to Nawa et al. (hereinafter "Nawa") and further in view of U.S. Patent No. 4,987,012 to Sato et al. (hereinafter "Sato") and U.S. Patent No. 5,670,088 to Chittofrati et al. (hereinafter "Chittofrati"); and rejects claims 7, 8, and 10-12 under 35 U.S.C. §103(a) over Sherif in view of Nawa further in view of Chittofrati and Sato and further in view of U.S.

Patent Application Publication No. 2002/0061816 to Uenishi et al. (hereinafter "Uenishi").

Applicant respectfully traverses the rejections.

By this Amendment, claim 1 is amended to recite in-part (emphasis added):

...contacting an organic phase having dissolved therein an organic compound of a metal alkoxide or an acetate-metal complex, the metal of said metal alkoxide or acetate-metal complex being hereinafter referred to as a first element, with an aqueous phase containing a second element as an ion, in a form of a microemulsion containing a surfactant, in which a hydroxide of said first element is produced by a hydrolysis reaction of said organic compound at the interface between said organic and aqueous phases while incorporating said second element in the in the hydroxide,
adding an alkali to the microemulsion to adjust the pH for colloid aggregation adjustment and maturing to form a matured product,
and
firing the matured product to produce particles of a compound oxide of said first element and second element.

The applied references disclose no such combination of features or establish any reason or rationale to provide such a combination of features. By this Amendment, claim 6 is amended to recite similar features and is patentable for similar reasons as discussed in connection with claim 1.

The Office Action acknowledges that Sherif fails to teach the presence of inorganic metal ions in the aqueous phase. See Office Action, page 5. The Office Action asserts that it would have been obvious to one of ordinary skill in the art to provide a microemulsion formed by contacting an organic solvent with an organic salt disposed therein with an aqueous solvent with aqueous salt disposed therein in the presence of a surfactant in Sherif in order to provide a mixed metal oxide having as taught by Chittofrati. See Office Action, page 5. Applicant respectfully disagrees.

Sherif discloses adding water to an organic solution containing an alkoxide and the formation of an emulsion, however, one of ordinary skill in the art would not have modified Sherif as proposed by the Office Action because Sherif teaches away from the presence of

mixed inorganic metal ions in the aqueous phase in favor of inorganic metals present only in the non-polar solvent, not the aqueous phase. See Sherif, col. 1, lines 14-24 and 45-52.

Specifically, Sherif teaches away from having inorganic metal ions in the aqueous phase in view of inhomogeneities that arise given the differences in densities of the differing salts. See Sherif, col. 1, lines 14-24, reproduced below for convenience.

It is known to form metal oxide powders from the inorganic metal salts by forming an aqueous solution containing the inorganic metal salt and adding it to an emulsion comprising a non-polar organic solvent, such as toluene, an emulsifier and an amine precipitating base. (See M. Akine et al., "Preparation of Yttria Powders by Emulsion Precipitation", Advances in Ceramics, Vol. 21: Ceramic Powder Science, pp. 57-67 (1987)). **Due to the differences in the densities of the differing salts, differential settling may occur prior to precipitation thereby giving rise of inhomogeneity.**

Thus, if Sherif is modified as proposed by the Office Action to employ an aqueous solvent with aqueous salt disposed therein, one of ordinary skill in the art would have expected that this modification would result in differential settling giving rise to inhomogeneities. One of ordinary skill in the art would thus have been led away from making such a modification.

Clearly, such a disclosure teaching away from the presence of inorganic metal salts in an aqueous solution to form metal oxide powders would not provide one of ordinary skill in the art with a reasonable expectation of successfully producing a highly homogeneous complex oxide by a process of contacting an organic phase having dissolved therein an organic compound of a metal alkoxide or an acetate-metal complex with an aqueous phase containing a second element as an ion, in a form of a microemulsion containing a surfactant, in which a hydroxide of said first element is produced by a hydrolysis reaction of said organic compound at the interface between said organic and aqueous phases while incorporating said second element in the product, much less to obtain a complex oxide with atom level uniformity as recited in claims 13 and 14. Thus, in view of the applied references as a whole,

such results are neither disclosed nor suggested in the applied references and the results of the currently claimed invention are unexpected.

Furthermore, Chittofrati discloses a microemulsion in which a surfactant is used, and an alkali is added thereto to form a compound metal oxide comprising metal elements that are derived from the aqueous and organic phases. However, the metal element in the organic phase forms a salt with the surfactant.

If the metal salt of a surfactant of Chittofrati, ferric perfluoroether monocarboxylate in the example, is added to an organic phase, when it contacts the aqueous phase, the salt is dissociated to release a metal ion (B^+ ion) into the aqueous phase, and forms an aqueous solution containing A ion that has originally existed prior to said contact in addition to B ion. In other words, the salt is dissociated at the time when it contacts with the dispersed aqueous phase and the metal ion (B^+ ion) is incorporated in the aqueous phase, to form an aqueous solution in which an ion that has been present from the start in the water phase (A^+ ion) as well as an ion that is newly incorporated (B^+ ion) are co-present, which Sherif teaches away from (emphasis added). Additionally, if an alkali is added, a compound metal oxide of A and B elements is formed by neutralization of A^+ and B^+ ions in the aqueous phase and, thus, aggregation adjustment is not necessary because the reaction occurs in the aqueous phase, not at the interface between the aqueous and organic phases, as recited in claims 1 and 6 (emphasis added).

Alternatively, if the timing of addition of an alkali is earlier, a reaction to produce a precipitation of A element first begins, followed by incorporation of B element into the precipitate, forming a final precipitate. This final precipitate may be a core/shell-type particle. Therefore, the uniformity of the compound metal oxide obtained in Chittofrati is considered to be not different from that of a compound metal oxide that is formed by a

conventional co-precipitation method in which A and B elements are co-precipitated from an aqueous solution comprising A and B ions dissolved therein (emphasis added).

Thus, Chittofrati (and the other applied references, as discussed below) do not teach, suggest, or establish any reason or rationale to modify Sherif to provide a first element in an organic solution and a second element in an aqueous phase, that reacts at an interface between the organic and aqueous phases of a microemulsion or to add an alkali to a microemulsion to adjust the pH for colloid aggregation adjustment and maturing, as recited in claims 1 and 6. Clearly, the only motivation for modifying Sherif in the manner asserted by the Office Action, in order to practice the claimed invention, improperly comes from Applicant's own claims and disclosure.

Nawa discloses that an aqueous solution including zirconium and cerium salts is mixed with an organic solution of an alkoxide of titanium to obtain a mixed solution, which is hydrolyzed by adding an aqueous alkali solution thereto, to thereby generate a precipitate (partially stabilized zirconia containing CeO_2 and TiO_2). See Nawa, col. 6, lines 40-47.

The Office Action asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention was made to provide an aqueous solution containing multiple metal elements in order to produce a mixed metal oxide as taught by Nawa. Applicant respectfully disagrees.

In view of Sherif's teaching away from the presence of inorganic metal salts in an aqueous solution to from metal oxide powders, if Sherif is modified as proposed by the Office Action to employ an aqueous solvent with multiple metal elements disposed therein, one of ordinary skill in the art would have expected that this modification would result in differential settling given the differing densities of the differing salts giving rise to inhomogeneity in the metal oxide product. Thus, one of ordinary skill in the art would thus have also been led away from making such a modification.

Furthermore, Nawa is only a co-precipitation, and is different from the method of claims 1 and 6 in that a microemulsion is not disclosed nor is there any reason or rationale to add an alkali to a microemulsion to adjust the pH for colloid aggregation adjustment and maturing.

Here, it is Applicant that has discovered a novel process where the second metal element ion (in the aqueous phase) is incorporated into the hydroxide obtained by the hydrolysis of the organic metal compound in a highly homogeneous manner by using microemulsions to produce a homogenizing effect, firstly by speeding the hydrolysis rate due to the extremely small microemulsion size of from a few nanometers to ten or more nanometers and the very large oil phase/aqueous phase interface (about 8000 m²/liter with a 10 nm size) and secondly by division of the aqueous phase, which results in an extremely small number of metal ions (approximately 100) per droplet. See specification, page 8, line 8 to page 9, line 25.

Nowhere do any of the references teach or suggest a process for production of compound oxide particles using a microemulsion containing a surfactant, in which a hydroxide of said first element is produced by a hydrolysis reaction of said organic compound at the interface between said organic and aqueous phases while incorporating said second element in the hydroxide and adding an alkali to the microemulsion to adjust the pH for colloid aggregation adjustment and maturing, as recited in claims 1 and 6, much less the compound oxide particles have a composition that is uniform at the atomic level (as recited in claims 13 and 14).

Sato is only relied upon for its teaching of adding an alkali and thus Sato does not cure the deficiencies of Sherif, Nawa, and Chittofrati with respect to claims 1 and 6 because Sato establishes no reason or rationale to provide a microemulsion containing a surfactant, in which a hydroxide of said first element is produced by a hydrolysis reaction of said organic

compound at the interface between said organic and aqueous phases while incorporating said second element in the hydroxide, as required by claims 1 and 6. Therefore, Sherif, Nawa, Chittofrati and Sato, considered either separately or combined, do not teach, suggest or establish any reason or rationale to provide each and every element of claims 1 and 6 and, thus, would not have rendered obvious claims 1 and 6.

As discussed above, Applicant submits that the Office Action is relying upon impermissible hindsight by relying upon the disclosed advantages of the claims, as provided in Applicant's own specification, as a roadmap for modifying the applied references. At the time the invention was made, there would have been no reason or rationale for one of ordinary skill in the art to have combined the applied references as proposed by the Office Action. Sherif teaches away from the presence of inorganic metal salts in an aqueous solution to from metal oxide powders and does not provide any reason or rationale to utilize a microemulsion. Furthermore, Sherif only states that a surfactant may be used and does not state any conditions that would allow for the formation of a microemulsion (i.e., a high water/surfactant molar ratio). Nawa discloses a method of producing a metal oxide by co-precipitation, but does not provide any reason or rationale to use a microemulsion or suggest that the reaction occurs at the interface. Chittofrati discloses a microemulsion, but the reaction occurs in the aqueous phase, not at the interface between the aqueous and organic phases. Sato is only relied upon for its teaching of adding an alkali, and fails to provide any reason or rationale for one of ordinary skill in the art to have combined the applied references as proposed by the Office Action. Therefore, the Office Action combines the references solely based on Applicants claims as a roadmap, which is clearly improper.

It is Applicant's disclosure that provides and claims a process for producing a compound metal oxide with an aqueous phase containing a second element as an ion, in a form of a microemulsion containing a surfactant, in which a hydroxide of said first element is

produced by a hydrolysis reaction of said organic compound at the interface between said organic and aqueous phases while incorporating said second element in the hydroxide.

Therefore, the combination of the applied references is improper and, as a result, claims 1 and 6 would not have been rendered obvious by the applied references, alone or in combination.

For at least the foregoing reasons, Sherif, Nawa, Chittofrati and Sato would not have rendered obvious claims 1 and 6. Claims 2, 4, 5, 13 and 14 variously depend from claims 1 and 6 and, thus, also would not have been rendered obvious by the cited references.

Claims 7, 8, and 10-12 variously depend from either claim 1 or claim 6 and, thus, require all the limitations of either claim 1 or claim 6. Accordingly, the deficiencies of Sherif, Nawa, Chittofrati and Sato with respect to claims 1 and 6 are equally applicable to claims 7, 8, and 10-12.

Uenishi fails to cure the deficiencies of Sherif, Nawa, Chittofrati and Sato with respect to claims 1 and 6. Thus, Sherif, Nawa, Chittofrati, Sato and Uenishi, considered either separately or combined, do not teach or suggest each and every element of claims 1 and 6 and, thus, also would not have rendered obvious claims 7, 8, and 10-12.

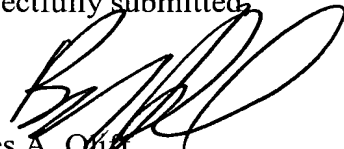
Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,


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Attachment:
Petition for Extension of Time

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